

**Forum international sur le caoutchouc, International Rubber Study Group (IRSG),
29-30 March 2004,
Limbe, Cameroon**

Typology of rubber based farming systems in Cameroon: lessons for future plantings

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Abstract

The rubber smallholder sector in Cameroon was developed in different zones, periods and conditions. As a result, the diversity of the rubber farms is important.

So, a typology of the farms, mainly based on the strategy for the development of the farming system, is proposed. Four different groups were identified: mini estate farms, family farms with continuous capitalisation of their income in plantations, family farms without capitalisation and emerging rubber family farms.

The analysis of the rubber practices during the different stages of a rubber plantation development shows that the four groups present some specificities concerning the choice of the planting material and the strategy of tapping. On the other hand, no difference was noted for the management of the plantation during the immature period.

Although the rubber smallholder sector in Cameroon is still limited compared to other African countries, it was possible to reveal that many farmers are interested in rubber. The diagnosis identified some difficulties that smallholders met for rubber cultivation. They have to be taken into consideration for the future plantings.

We would like to thank our colleagues Simon Gobina, Jetru Njukeng (NRRP) and Jean Marie Eschbach, Eric Penot (CIRAD) for the rereading of this communication.

Introduction

Although smallholders represent about 80% of the total area and production of natural rubber in the world, the situation in Cameroon is quite different: they only represent 7.4% of the area planted and 5% of the national production. The development of the sector is very limited. Regarding the area planted, smallholder share is one of the lowest of the main African rubber producing countries.

Though, rubber is an interesting crop to improve the conditions of life of small and medium farmers. Contrary to cocoa or coffee which are seasonal, the production of rubber is regular all over the year generating a monthly income; this is a great advantage for African farmers who often have problems to save their money. Like rubber, cocoa and coffee are cash crops, sold on the world market, so rubber is complementary to these crops: when the price for one commodity is low, it can be compensated for by the other. On the other hand, oil palm can be processed and sold locally, so it can reduce farmers dependence on international markets. As the other perennial crops, rubber has a long economic life: it can be exploited for more than 30 years if well managed. It constitutes a real capital for the future (farmers retirement, heritage) as well as a kind of savings (renting out the plantation to meet family exceptional financial needs). Once the rubber trees are on tapping, the cost of production is low; on the whole, it is limited to the cost of labour for tapping.

In 1999, a research programme funded and technically assisted by the French Cooperation and CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement) started. The aim of this programme was to contribute to the identification of the modalities for the development of rubber small and medium plantations in Cameroon. A diagnosis of the sector was carried out which focused on the analysis of the farming systems and the smallholders rubber practices.

In this communication, we will first describe the different phases of the development of the rubber smallholders in Cameroon. Then, a typology of rubber smallholders based on the evolution of their farming systems will be presented. After that, the characteristics of the rubber practices for the different groups will be explained. It will end with the highlight of the constraints smallholders are facing and with some prospects for the future plantings.

1. A brief overview of the Cameroonian smallholder sector development

In 2003, smallholder plantations were covering about 4000 ha and they were producing about 3000 T of rubber. There are supposed to be about 550 smallholders as a rough estimate.

The rubber plantations now existing in Cameroon have been developed in several areas, under various conditions and during three different periods.

The first smallholder plantations were created at the beginning of the 20th century incited by the Europeans (German). These plantations are located in the Centre, the South and the East provinces; the area planted at that time was estimated at about 2000 ha. They were private as well as collective plantations. Presently, many of them still exist although the density of the trees has decreased due to their age. In 1995/96, it was estimated at around 330 trees/ha which is rather good for plantations of this age (Bouchitte *et al*, 1996). However, they are rarely exploited; most of them

were abandoned after the departure of the Europeans. Presently, due to the price fluctuation of cocoa and the low price of coffee for several years, after they have already started to develop food crops for sale, farmers are interested in rubber to diversify their source of income mainly based on these two perennial crops. The rehabilitation of the old rubber plantations could be a base for a future development of smallholder rubber plantations in these provinces.

Most of the rubber smallholder plantations were created during the 1980's, when the Cameroonian government launched two smallholder rubber development projects partly funded by the World Bank. The first one was implemented between 1978 and 1986 in the South-West province and the second one between 1982 and 1990 in the South province. Two public agro-industries (CDC in the South-West and HEVECAM in the South which was privatised since 1996) were the technical operators for the implementation of these projects. A total of 1343 ha of smallholder plantations was developed. For the majority of these farms (902 ha), the plantations were settled by the farmers themselves on their own land under the control and supervision of the estate. Smallholders received a credit to plant and maintain the rubber trees to maturity; this credit had to be paid back gradually when the plantations started producing. The average area of the plantations was 3 ha per farmer.

In the South province, the local population was small and not really interested in the programme. Within this kind of scheme, only 80 ha of plantations could be created. Consequently, HEVECAM had to establish the plantations on its own concession (441 ha). They were settled by the estate and given "clef en main" to the workers (sometimes to HEVECAM employees) who were supposed to pay back the credit when the plantations start producing. The area of the plantations was higher than the other model of development; each farmer received an average of 8 ha of rubber plantation.

One can note that the area planted under these two development projects is very low compared to other African countries like Ivory Cost (20000 ha) or even Ghana (3055 ha) and Gabon (3000 ha), two countries where the programmes started more recently. And yet, the role of development projects to initiate the dynamics of plantation is very important, particularly when the crop is newly introduced in the smallholder sector: diffusion of technical information, demonstration of the feasibility and the performances. The weakness of the intervention of the Cameroonian State and the international aid to promote smallholder rubber plantations certainly explains the limited development of the sector. Indeed, although rubber was planted in the country since the beginning of the 20th century, there were few spontaneous plantations. Rubber is still a crop largely unknown by the majority of farmers. Therefore, its adoption at a large scale needs financial incentive and, above all, technical assistance.

However, during the 1980's when the development projects were implemented, and sometimes before, some farmers also planted rubber without any assistance. They are participants of the projects making some extensions by themselves or farmers who were not able to plant rubber within the framework of the project. These self-funding plantations are located in the South-West province, in the villages where the project was implemented (in 2001, they represented 1991 ha). They include four big size plantations representing a total of 1399 ha. The other 592 ha were planted by farmers called outgrowers. The area planted is very variable; 0.1 to 74 ha. The average is about 2.5 ha per farmer.

Many of these plantations as well as the ones settled by the projects are now getting old and exploitation was generally not well managed. However, a great majority of the smallholders rubber comes from these plantations created during the 1980's.

Lastly, some rubber smallholder plantations were created in the second part of the 1990's. Between 1995 and 1998, HEVECAM settled two pilot nurseries to produce planting material. This has incited the creation of some smallholder plantations in the South province, outside the area of implementation of the project; but the number is limited; they are mainly belonging to some "elites". So the size of the plantation is larger and the population concerned is different. But these "elites" who are really interested in the crop could contribute to initiate the development of rubber plantations at a larger scale.

In the South-West province, some plantations were also established but without any incentive from the agro-industry. It seems as if the increase of the rubber price in the world market as well as an improvement of the economic interest of the export crops after the F CFA devaluation were at the origin of these plantations. They correspond to:

- the extensions of the existing rubber plantations,
- the introduction of rubber in exploitations based on food crops or on another cash crop, mainly cocoa,
- the investment of civil servants or employees preparing their retirement.

There is no exhaustive list of the rubber plantations created in the 1990's (only producing plantations are registered). But, from field experiences, it is obvious that the dynamics of self-funding plantings was, and is still, very limited.

Currently, the majority of the rubber smallholders (and outgrowers) plantations exploited are located in the South and South-West provinces, in the area of influence of the two agro-industries HEVECAM and CDC, where the development projects were implemented. Therefore, up to now, the great majority of the studies carried out focused on these two areas.

2. A typology of the farms

Partly due to these modalities of development of the rubber smallholder sector, the diversity of the farms is important. Therefore, there is a need to establish a typology. Based on a survey carried out with 36 farmers in the CDC and HEVECAM areas, a typology was proposed by T. Michels (2001). Following studies (notably Chambon, 2002 who interviewed 35 farmers around CDC) completed the information focusing on the farmers who developed rubber plantations during the second part of the 1990's.

The diagnosis made by T. Michels (2001) showed that the present dynamics of rubber smallholder¹ plantation development is closely linked with the strategy of development of the farming systems. So the information he used to establish a typology were as follows:

- socio-professional origin of the farmer,
- constitution of the farming systems: nature and evolution of the crops,

¹ All along this communication, when we write smallholders, we also include outgrowers.

- evolution of the family,
- labour used for farming activities,
- characteristics of the rubber plantations.

Four different groups could be identified whose characteristics are given below. Table 1 synthesizes the information described below.

Table 1: characteristics of the different farmer groups

	Mini estate	Continuous capitalisation	No capitalisation	Emerging rubber farms
Socio-professional origin	High	Modest	Modest	Various
Origin of the land	Bought	Bought, inherited	Various	Various
Usable area (ha)	High (16.5-86)	High (7-55)	Low (2.5-22.5)	Low (3-12)
Rubber area (ha)	> 10 ha	3.5 - 10 ha	3 - 15 ha	> 5 ha
Labour	Paid labour including permanent Low family labour (food crops only)	Seasonal paid labour Involvement of family labour	Seasonal paid labour Involvement of family labour	Seasonal paid labour Strong involvement of family labour
Extension of rubber	No systematic but possible	New plantations after 1995	No new plantation	First rubber after 1995
Extension of other crops	No systematic but possible	No systematic but some planted mainly oil palm and cocoa	No new perennial crops	No systematic but the trend is to diversification

Source: enquêtes T. Michels (2001)

Mini estate farms

The farmer is often a local elite (agro-industry middle ranking executive, civil servant, contractor, business man) or, more rarely, he has a farming origin. The acquisition of land was usually through purchase. The farmer was able to buy large areas of land; the usable agricultural area varies from 16.5 to 86 ha.

Through his participation in the project and/or from the income generated by another farming or off-farm activity, he could develop a large area of rubber plantation which is now rarely under 10 ha. He is therefore above the average; most of the smallholders (64%) have less than 3 ha of rubber.

Due to the large usable agricultural area, the farmer pays for labour. Very often, he employs permanent labour; but he also uses seasonal labour or sharecroppers, notably for the cocoa plantations. Family labour is rarely implicated in the farming activities except for food crops cultivation. But the farmer or one of his son is in charge of the supervision and control of field works for rubber and the other tree crops.

Most often, the first rubber plantations were created with the assistance of the project. Some farmers created new rubber plantations in the second part of the 1990's. At the same period, some also planted other perennial crops. However, capitalization by extending rubber plantations or developing other perennial crops is not systematic. But it seems as if these farmers have the means to do it.

Family farms with continuous capitalisation

The socio-professional origin of these farmers is modest. They are small contractors, working in the informal sector or workers; many of them have a farming origin.

In most of the cases, the land used for farming was bought or inherited. The area may be large and varies from 7 to 55 ha.

The main difference with the previous group is the involvement of family labour in all the farming activities, not only for food crops.

Sometimes, the development of perennial crops started with rubber. But very often, rubber was introduced in the farms where other crops, mainly cocoa or sometimes coffee, were already cultivated. Rubber was an opportunity to diversify the farming system. This situation is very common in the South-West province where cocoa and coffee were planted for long.

Rubber was introduced in these farms by the end of the 1970's or beginning of the 1980's. Many of the first plantations settled benefited from the assistance of the project but some were also self-funding. The total area now planted with rubber varies mainly from 3.5 to 10 ha; but some plantations are still immature.

The use of paid labour is mainly reserved for the producing plantations, labour used is principally seasonal. Some smallholders also employ sharecroppers for the productive cocoa plantations.

One of the main characteristics of this group is that, up to recently, farmers continued to capitalise part of their incomes (mainly generated by the mature rubber plantations) in perennial crops. They extended the area of their rubber plantations after 1995; some also developed plantations of other crops, mainly improved oil palms.

The area of these developments is sometimes linked to the availability of the family labour. Indeed, even if they used paid labour for some of the tedious works during the establishment and the immature period of the plantations, family labour also plays an important role. When the area planted is not determined by the availability of family labour, if this latter is low and if there is no money to pay for external labour, the maintenance of the young rubber plantations is neglected. This results in slow growth and in delays for the opening of the trees as they mature late. When the area of producing rubber plantations is above 5 ha, it seems as if the farmer is able to pay for labour to maintain the immature plantations. But very few farmers in this group have more than 5 ha of mature rubber.

Anyway, even if it was not always done in the optimal conditions, these farmers anticipated the replacement of their productive capital in order to guarantee a certain continuity in the rubber income.

Family farms without capitalisation

The socio-professional origin of these farmers is the same as the previous group.

The modalities of access to land were varied: purchase, heritage, use of the land from the estate concession or use of the lands opened from the forest. The usable agricultural area is globally lower than for the two previous groups: it ranges from 2.5 to 22.5 ha. The smallest area are for the farmers who bought their lands.

The rubber plantations were created by the end of the 1970's and beginning of 1980's within the framework of the projects or without any assistance. The area planted varies with the region. Around CDC, it is usually below 3 ha but it can reach 15 ha in HEVECAM area, for the plantations created on the concession.

This group of farmers is characterised by the absence of any investment in perennial crops after they created their rubber plantations in the 1980's. So these farms are mainly relying on ageing plantations; if they do not undertake some new plantings,

their income will start decreasing because rubber plantations are damaged by fire disasters or due to root disease. Two main reasons were identified for the absence of any new plantations (Michels, 2001):

➤ access to land is often a constraint. Some of these exploitations are already cultivating all available agricultural lands. In the South-West province, the extension of the area of perennial crops would suppose the acquisition of land. This often means that for new developments, farmers would need financial means to buy land. For the farmers who have their rubber plantations on HEVECAM concession, the extension of perennial crops supposes the acquisition of land outside the concession. But landholding situation is not sure which makes the farmers hesitate to invest in perennial crops on these lands. Due to this landholding situation, the trends for these farmers is to develop food crops.

➤ the role of family labour is also often important in the creation and maintenance of the new developments. The lack of family labour can be another constraint for any new investment in perennial crops. The exploitations gathered in this group often have little family labour.

Emerging rubber family farms

This group is made up of the farms where rubber plantations were created only recently, that is to say during the second part of the 1990's. Since there were not any projects at that time, they are all self-funded and most of them were planted without any incentive from the agro-industries.

The socio-professional origin of these farmers varies: students, workers, middle ranking executive, civil servants and many also have a farming origin. So, they were able to develop rubber plantations from the income generated by a farming or an off-farm activity; some also borrowed money from family or friends.

The access to land was through purchase, heritage or it was opened from the forest. The total usable agricultural land is small, ranging from 3 to 12 ha.

For most of the cases, rubber was the first perennial crop planted. Few farmers have not developed other crops up to now; but they plan to diversify their farming systems in the next future. For the farms with diversified farming systems, rubber represents the main perennial crop in terms of area; most of the time, the area is above 5 ha.

Although they sometimes pay for labour (seasonal labour), family labour plays an important role in the farming activities. Most of the work is done by the farmer assisted by his wife as such, the area planted is often closely link to the availability of family labour for the maintenance. When it is not the case, the maintenance of the plantations is poor, except if they have some financial income to pay for labour or if it is possible for them to turn to mutual aid.

The farmer is usually young. The creation of the rubber plantation was linked with his return to the village after trying to get a job in town, with his wedding and/or the prospect to have a family or to extend it.

3. Some characteristics of the rubber smallholder practices

From the typology presented above, we know that productive and immature rubber plantations are currently present in the farms. Some of them have the two.

So the next step will be to describe the farmers practices concerning:

- 1) the exploitation of the rubber plantations created during the period of the development projects. This will be based on the work done by T. Michels (2001)
- 2) the establishment and the maintenance of the self-funding plantations, particularly the recently settled ones. This will be based on the surveys carried out by B. Chambon in 2002.

The objective is to highlight the similarities or the differences between the different groups of farmers.

3.1. Exploitation of the mature plantations

One of the characteristics of the Cameroonian rubber farmers is that even if most of them know how to tap, they prefer to pay for a tapper. The payment is always depending on the quantity of rubber produced. Smallholders also pay for labour for the maintenance of the mature plantations (Michels, 2001).

Whatever the group they belong to, when the plantation starts to produce, family labour is not working anymore in the rubber plantations. The role of the farmer is just supervision and control.

T. Michels (2001) identified two kinds of strategy for the management of tapping which characteristics are summarised in table 2.

Table 2: characteristics of the strategies for management of tapping

	Characteristics
Preserving the rubber trees	<p>Tapping practices to maintain a high density of tappable trees and to limit bark consumption</p> <p>Incentives to tapper</p> <p>Good technical knowledge of the farmer or the tapper</p> <p>High implication of the farmer in the control of the plantation</p>
Intensification of tapping	<p>Tapping practices to increase the short term production</p> <p>Temporary intensification for farmers with good technical knowledge and strong involvement in control</p> <p>Continuous intensification for farmers with few technical knowledge and little involvement in control</p>

Source: Michels, 2001

3.1.1. Strategy 1: preserving the rubber trees

The farmers who chose this strategy wish to optimise the length of the economic life of their plantations. The objective is double:

- 1) maintain a high density of the tappable trees as long as possible.
- 2) preserve the bark capital of the trees.

This strategy is usually adopted by the farmers who have a good technical knowledge about rubber tapping. When it is not the case, the farmers employ a well

qualified tapper. In both situation, the farmer is highly implicated in the control of the plantations; he visits them regularly.

Some of them are also using incentive measures like a higher wage or the adoption of sharecropping system which increase the income of the tapper. The objectives of better paying the tapper are to make him steady and to discourage him from intensification.

3.1.2. Strategy 2: intensification of tapping

The objective of this strategy is to maximise the short term income. But this is often done to the detriment of the long term potential of production of the trees.

T. Michels (2001) observed two situations:

1. the farmer has a good knowledge of rubber and exploitation; he controls regularly his plantations to check the quality of the tapping. In this case, intensification was a wish of the farmer himself. He wanted to compensate for the drop in the rubber price in order to maintain the same level of income. This was observed when the rubber prices were getting down. But, it seemed to be a temporary intensification. The rise of the rubber price incited many of these farmers to abandon the intensification practices.
2. the knowledge of the farmer concerning rubber and tapping is limited. His implication in controlling the plantation is also small. So, the farmer leaves the tapper decide about the tapping system. Since in these exploitations, tappers are usually paid according to number of kg of wet rubber produced, their interest is to increase the short term production. So, they intensify the tapping and in this case, intensification is constant. Indeed, these practices are not related to the variation of the price paid for rubber. The adoption of this strategy has negative consequences for the plantations.

3.1.3. Strategy for the management of tapping and typology of the farms

Even if the situations are variable in the sense that not all the farmers from one group follow the same strategy concerning the management of tapping, some trends were highlighted by Michels (2001).

Most of the mini estate farms follow a strategy of preserving their trees. Some also intensified the tapping when the rubber price was low. But, among all the farmers met, there was no continuous intensification. It shows that, in this kind of farms, there is a control of the tapping system either by the farmer himself or by a supervisor that he employs. More over, it seems to indicate that the level of income certainly allows these families to support some variations in the income generated by rubber. And so, they give more importance to the future than the short term income.

This was not the case for the farms without capitalisation. Many of them adopted intensification practices. But for the majority, intensification was decided by the smallholder and it was temporary. For many farmers, rubber was just an opportunity and it is just considered as a source of income. So when the price is low, they intensify to maintain the level of income generated. This may have been the only choice for some farmers; indeed, in this group, several farms have a mono-specific farming system. Therefore, the income highly depends on rubber.

Lastly, among the farmers who capitalized part of their income in some new developments, the situation is more heterogeneous. They can follow any of the two strategies identified (and the variants of the second one), depending on their objectives and level of implication in the supervision and control of tapping.

In spite of these different trends, a general assessment is that the management of tapping for the plantations created by the 1980's was not optimal. The level of income generated by rubber could certainly be improved; and, above all, the long term production of the plantations is not guaranteed. Poor management of the panel and poor tapping quality are very common. Many plantations established during or by the development projects, although still relatively young, are already close to the end of their economic life.

3.2. Establishment and maintenance of the self-funding plantations

Although they received no incentive and no assistance, some farmers developed rubber plantations. Emphasis will be here on two points which were identified critical for some farmers and can have important consequences on the plantations productivity.

3.2.1. Establishment of the rubber plantations

The choice and the quality of the planting material is essential since it will determine, on the long term, the income generated by the plantation and so, the productivity of the factors of production involved in the establishment and the maintenance of the plantation.

Planting material used for the settlement of smallholders plantations

Although budded planting material is known and very often recognised by the farmers as the best planting material for developing rubber, many plantations were created with seedlings. Seedlings use usually reflects the will of the smallholders to limit the investment; it reveals the technical problems encountered by farmers for budded planting material production and also shows their lack of information concerning the access to the clones.

However, a positive assessment is that seedlings use for the recent plantings appears to be lower than it was for the self-funded plantations created during the period of the rubber development projects (Chambon, 2002). This seems to indicate the positive impact of the programmes: making the farmers aware of the superiority of the clones, easier access to budded planting material.

In spite of the difficulties mentioned above, some smallholders were able to plant budded planting material. Farmers have two alternatives to get some clones: buy it from an agro-industry or produce it themselves.

Very few farmers bought the planting material from the agro-industry. Most of the new plantings were realised around the CDC which was only selling polybag stumps. So, the cost of planting material was very high (see table 3). It could amount to two thirds of the investment necessary for setting up a plantation and 40% of total investment from land clearing to maturity (Plaza survey, 2003). Therefore, it is considerable, unaffordable for many smallholders.

Table 3: cost for planting material

	Clones bought	Clones produced
Unit cost	425 to 450 FCFA/polybag	50 FCFA/successful budding
Cost per ha	235 000 to 250 000 FCFA/ha	28 000 FCFA/ha
Cost including transport	250 000 to 480 000 FCFA/ha	

Source: Chambon (2002)

That is the reason why very often, the planting material was produced at the farm level. Most of the time, the farmers chose to plant seedlings and do the budding in the field. Costs were minimized, since they were generally limited to paying the budder. The investment in planting material was highly reduced (see table 3). Field budding also offered smallholders the advantage of avoiding the establishment and maintenance of a nursery. Indeed, many farmers lack technical knowledge in this field. The few smallholders who settled a nursery mainly produced polybag stumps. They knew how to manage a nursery or they paid for a technician to do it for them.

In both cases, budding is mainly done by a technician, usually trained by the agro-industry. But the budwood rarely comes from a budwood garden. Agro-industries are currently the only suppliers; the existing budwood gardens were for long under-used, particularly in CDC area since the agro-industry suspended its replanting programme in 1996 (it will just start again this year). However, farmers were not always informed about the importance of using budwood coming from a budwood garden; they also did not know the possibilities of obtaining budwood from the agro-industry. Consequently, budwood was usually taken from branches in the CDC clonale plantations or from the older smallholder plantations. Therefore, for the self-funding clonale plantations, in most cases the origin of the budwood raised the problem of the quality of the budded planting material produced and planted on smallholdings (genetic conformity and clonale purity).

Improving the access to good quality budded planting material is a necessary condition for the development of smallholder plantations.

Typology of the farms and access to planting material

The behaviour of farmers concerning the planting material used for rubber developments varies from one group to the other (see table 4).

Table 4: trends for planting material used for the different groups

	Characteristics
Mini estate farms	High use of clones Polybag stumps Clones bought from the agro-industry
Farms with continuous capitalisation	High use of seedlings Clones produced
Emerging rubber farms	High use of clones Clones produced

Source: enquêtes B. Chambon, 2002

It is for the smallholders gathered in the first group (mini estate farms) that the use of budded planting material was far the highest. Most of the existing plantations in these farms are clonale plantations. This concerns not only the plantations created within the framework of a project but also the self-funded plantations established in the 1980's or after 1995. Many of the farmers planted polybag stumps. The proportion of

the plantations created with budded planting material bought from the agro-industry is also higher than for the other groups.

This indicates that these farmers had the financial means to plant the more expensive planting material and also to buy it from the agro-industry which should be a guarantee of the quality of the plants. Due to their social status (local elite), they may also have a better access to improved planting material than the other smallholders. But, they also seemed to have not much knowledge about the production of budded planting material. So, for them, since money is not really a constraint, buying the clones from the agro-industry appeared to be the best strategy to make sure of the long term productivity of their plantations.

In the farms with continuous capitalization of part of the incomes in new developments, many of the self-funded plantations were created with seedlings. The use of this unimproved planting material represents the majority of the plantations created in the 1980's (except project plantations) as well as in the late 1990's.

When these farmers used budded planting material, it was produced at the farm level and not bought from the agro-industry in order to reduce the cost of establishment. The area of mature rubber farms is much smaller than for the previous group. And in most of the farms, the new developments capitalized the income generated by the mature rubber plantations. So, the farmers had to adapt the investment to the available capital.

The use of budded planting material was much higher for the emerging rubber family farms. Most of the clones were produced at the farm level. It seems that these smallholders have a better knowledge about clones and the production of budded planting material. That may be the reason why, despite the financial constraint, they gave more importance to the production of clones.

Some farmers were also able to buy the planting material from the agro-industry. The origin of the capital invested in the new developments is very diversified. The farmers who bought the clones invested part of the income generated by an off-farm activity.

The choice of the planting material used for the establishment of the new developments is closely linked to the capital available in the farms. In the present conditions, the access to the best quality budded planting material, i.e. produced in a nursery and using budwood from a budwood garden, is limited for some farmers due to its high cost. And globally, farmers lack knowledge and know-how about the production of planting material.

3.2.2. Maintenance of the plantation during the immature period

Once the rubber trees have been planted, the maintenance of the plantation during the immature period, particularly during the first three years is essential. It has a strong influence on the growth of the trees; therefore, it will influence the length of the immature period. This period is critical, specially for small and medium farmers, due to the investment necessary without generating income.

Below, focus will be put on the upkeep of the plantation and the management of the interrow. Fertilizer application will not be treated here since the great majority of the farmers never used it for the self-funding plantations, even when they seem to meet no major financial constraint.

Management of the immature plantations

Weeding is always carried out by hand. Irrespective of the number of years after planting, two assessments can be established:

- Most farmers completely weeded the plot (row and interrow)
- Upkeep in young plantings was far from what is usually recommended to guarantee optimum rubber tree growth (Chambon, 2002).

Michels (2001) showed that planting with an annual weeding rate not exceeding two rounds displayed substantially retarded growth. Beyond two rounds, growth rates were acceptable. Yet, only a third of the plantings visited in 2002 were weeded more than twice a year, at least in the first two years.

Plantation upkeep during the immature period is considered as an important financial burden for family farms, particularly as the size of the plots set up in the second half of the 1990's was large, at around 4 ha on average (Chambon, 2002). Usually, plantation upkeep was ensured by hired labour from outside the family paid on a piece work basis. The annual cost of weeding with two rounds per year amounted to around 35000 CFA F/ha (Plaza 2003). This was the capital that smallholders were prepared to invest.

In order to facilitate upkeep in immature plantings, a certain number of smallholders had planted intercrops in the rubber interrow. When there was no intercrop, the plot was left bare; cover crops were rarely used. Intercrops were usually planted the first year after rubber planting. They then decreased steadily each year, and they disappear at the fourth year after planting.

The type of intercrops varied as the plantation aged: multi-annual crops tended to replace annual crops. Cassava, cocoyam, maize, egusi melon and plantain banana were the most frequently encountered crops. Cassava and plantain were sometimes planted as pure crops in the rubber interrow, but usually, as seen in plots reserved for food crops, mixes of crops were usually grown.

Intercrops were usually managed by family labour sometimes assisted by paid labour or a mutual aid group. Intercrops could also be planted by persons who did not belong to the family.

When crops were intercropped with rubber, they were not systematically planted over the entire plot. The cultivated areas varied substantially; some farmers practised shifting agriculture within their rubber plantation. The factor limiting the cultivated area was usually the work force, or possibly land conditions: too steep a slope, expected yields were too low so food crops were sown on other land (Chambon, 2002).

Management of the immature period for the different groups

The analyses of the practices of the smallholders during the immature period of their plantations could not point out any significant differences between the groups of farms. The cultivation of annual or pluri-annual food crops in the interrow of the rubber plantations is represented in all the groups. As it was earlier written, the upkeep of the plantations is always low. However, although it is small, the proportion of farmers from the mini estate farms and the emerging rubber family farms who upkeep their plantations as recommended is a bit higher than in the family farms with continuous capitalisation. This may be related to the more important use of the clonale planting material for these two groups; it seems to show that when they invested in budded planting material, farmers try to maintain it properly. Or, these are the farmers who have more financial means than the others.

As a conclusion, some different rubber practices have been identified notably concerning the management of the tapping and the choice of planting material for the self funded plantations. This shows that access to technical information and to capital is variable according to the different groups of farms. In the present conditions of rubber farming, the establishment and the maintenance of a rubber plantation is very costly. The fact that farmers were able to develop plantations without any assistance shows their capacity to mobilize their own money to plant rubber. That is a very positive point for the development of the sector.

4. What prospects for the future plantings?

Although it is still limited, the development of the self-funded plantations, particularly during the second part of the 1990's, reveals the interest of the smallholders for rubber plantations. From the discussions with farmers, it is clear that the crop presents a lot of advantages for them.

This is favourable to the development of the sector. But the diagnosis also highlighted some difficulties that smallholders had to face during the establishment, the immature and the mature periods of a rubber plantation. These difficulties must be taken into account for the future plantings.

4.1. Towards a better access to budded planting material

From field experiences, it is obvious that there is a need to improve the access of smallholders to good quality planting material at an affordable price. No smallholder should be excluded from the use of this planting material. This is essential for the farmers future income. They should not use seedlings anymore. They should not plant budded planting material that they are not sure about the quality. Up to now, the budded stumps produced by the agro-industries are the only ones which quality is guarantee. The price is high and they can be very far from the locations where the plantings are to be settled. They are not always available when farmers plan to create a new plantation.

All this indicate that there is a need to move the production of budded planting material closer to the farmers and to focus on the clones suitable for the smallholders conditions. The lessons from the above typology suggest that farmers who continue to capitalize part of their income in perennial crops as well as the emerging rubber farmers should be the target groups for these activities.

Therefore, a network of production and distribution of budded planting material should be encouraged to guarantee the durability of the access to planting material, even when there is no development project. This can be through the incentive and assistance to the development of private nurseries. They would provide the clones to the farmers who have money and prefer to buy the planting material. The production of improved planting material could also be realised by the smallholders, within the framework of farmers groups. This would rather be directed at the farmers who have available family labour and who wish to reduce the monetary cost for the creation of the plantations.

In both cases, a special attention should be put on the clonale purity and conformity.

4.2. Improving the farmers technical knowledge and know-how

A better access to planting material alone would not be enough to improve the conditions of implementation and later exploitation of the future plantings; an important emphasis should also be put on smallholders technical information and training. Farmers still need to acquire knowledge and know-how about rubber cultivation. Information and training should be directed to the farmers located in the areas where rubber plantations are less developed but which were identified as potential for the development of rubber plantations outside the influence zones of CDC and HEVECAM. But it should also concern the actual rubber smallholders whatever the group they belong to.

The development of a network of production and distribution of planting material should be completed by a large information of the smallholders about the budded planting material, the interest of budding, the necessity of using budwood produced in a budwood nursery. They should be informed about the different clones, their characteristics in order that they can choose the one(s) which better fit their objectives.

Concerning the immature period, extension should make the farmers aware of the need to adapt the area planted with the available family labour or to the future capacity of the family to mobilize some capital to pay for labour. We already mentioned that the area of the plot planted during the 1990's is big, around 4 ha. When they have the means to develop a large area, smallholders plant rubber; but they do not anticipate the future needs to maintain properly the farm. This can lead to the lost of the investment already made.

For the management of the mature period of the rubber plantations, farmers need to be informed about the functioning of a rubber tree, the specificity of the various clones and the consequences of the different practices (tapping, stimulation). The objective is to make them able to decide the strategy of management of the tapping that they want and its consequences on the future of the yield potential; they should also be able to carry out an efficient control of tapping.

Lastly, since smallholders are not tapping their plantations, training and information should also be directed to the tappers.

4.3. Securing the conditions of commercialisation of the production

The impact of the improvement of smallholders access to planting material and technical information would be limited if the conditions of commercialisation of rubber are not sure. This is one of their major concerns for smallholders. Indeed, rubber is a raw material which needs to be processed. Therefore, smallholders are highly depending on the commercialisation network. Currently, the commercialisation of rubber is very simple and direct: the farmers carry the crop to the factory. Although they have the choice between three companies (at least for the self funded plantations or the project plantations which loan is completed), in reality, due to the transportation costs, they have no alternative but to send the crop to the closer factory. In some areas, farmers have to face very long delays in payment. Even when they deliver the crop every month to the factory, they can stay for several month without being paid for their crop. This creates some difficulties for the family; it also has some negative consequences on the management of the rubber plantations: problems to buy the inputs and, over all, to pay the tapper. For many plantations,

tapping has become irregular; some were even abandoned. Smallholders start to be discouraged and some think of replacing their rubber plantations by other crops.

In 1995/96, HEVECAM rehabilitated some of the old rubber plantations in the Centre, South and East provinces. First, the agro-industry sent trucks to carry the production to the plantations. With the privatisation, HEVECAM stopped all the support given to smallholders who then had to organize and pay for the transport. Due to the distance from the rubber factories, the cost of transportation for cup lumps is very high. For instance, from the East province plantations to the factory (700 to 800 km), it was estimated at about 100 CFA F/kg of dry rubber which is five times higher than the cost of tapping (Chambon, 2003). With this transport cost and with the present situation (commercialisation of cup lumps), tapping is not very economically interesting. This is particularly true when the price for rubber is low. The improvement of the conditions of commercialisation for the plantations located far from the factories also concerns the plantations settled in the second part of the 1990's by the "elites" in the South province which will soon start to produce.

These different situations underline the necessity of securing the conditions of commercialisation of the crop. This is an essential point concerning the context of the future plantings.

4.4. Supporting the emergence of farmers groups

Also concerning the context of the future rubber plantings, it seems that the creation of farmers' organisations would be very useful. Yet for research, development organizations and donors, the merits of producer groups for family farms are widely accepted. They are assumed to enable individual farmers to solve problems encountered in their agricultural activities (access to planting material, various inputs, technical or commercial information and training) and to defend their interests. They can also be a means of funding agricultural activities on each farm, by setting up systems to generate internal and external savings. Funding for their activities, particularly rubber plantings, is a recurring problem for farmers. They should be able to mobilise their own savings; but some may also need loans, particularly those who have no perennial crops neither off-farm activity. But in all the cases, in the smallholders' interest, loans should be limited and self-funding should be strongly encouraged.

However, the smallholder sector is only weakly structured at the moment; there are virtually no farmer groups. Therefore, it seems that the emergence of efficient rubber smallholder groups should be incited and supported. Nevertheless, it is important to avoid creating organizations of a purely opportunistic nature, whose sole objective is to obtain outside aid, without any local dynamics backed up by one or more clear economic or social objectives (Diagne D, Pesche D, 1995). So, rubber growers would gain from setting up well-structured farmer organizations, with clearly defined objectives.

Conclusion

In Cameroon, rubber smallholder sector is under-developed. But, it is existing and many conditions seem to be favourable for its extension.

From the past experiences, notably for the last 30 years, lessons can be learned. In order that the future plantings are implemented in good conditions, it is necessary to

take the past experiences into consideration. Research as well as development institutions and international funding agencies have an important role to play.

Research should be able to give some technical recommendations adapted to the local conditions to reduce the production costs for smallholders and so, increase their income. The research activities should focus on the management of the immature period (control of forest regrowth, intercropping), pest and diseases management as well as the optimisation of the tapping systems and the improvement of the organisation of tapping. Indeed, information and training of the tappers may not be enough, they also need incentives (financial?) not to over tap the rubber trees.

Moreover, parallel to the incentive and assistance to the creation of a network of production and distribution of planting material, an applied research programme should study the possible constraints to its development and identify the best conditions to implement this activity.

Lastly, one of the main constraints for the development of the rubber plantations distant from the factories is the high cost of transport of the production. Therefore, some research activities should be carried out to assess the possibility of developing rubber pre-processing by smallholders. The NRRP (National Rubber Research Programme) has already started to work on it. A prototype of a mini-creper has been constructed and on station studies were conducted. The machine should now be transferred to the field to continue with on farm trials.

Developing rubber smallholdings is an important issue for the country. It would contribute to increase and diversify more the government incomes and to improve the conditions of living of many families.

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